

Technical Note

CESA – A New Modality for the Difficult Aortic Aneurysm

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INTRODUCTION

A thoracic aortic aneurysm (TAA) is a life-threatening condition with a 20% five-year survival in untreated patients.¹ Rupture is invariably fatal. Surgical repair should be considered when the aneurysm is >6cm in diameter, rapidly enlarging, or impinging on adjacent structures.¹ Open repair, via a left thoracotomy carries significant morbidity and mortality rates.¹⁻² More recently, endovascular repair of TAA has become an acceptable alternative to open repair with lower peri-operative morbidity and mortality rates.³⁻⁴ The combination of both open and endografting techniques has further expanded the options for treatment of TAA especially for complex lesions which involve the visceral arteries.^{2,5} We present a case of combined endovascular and surgical approach (CESA) for the treatment of a TAA in a patient with a previous open abdominal aortic aneurysm (AAA) repair.

CASE REPORT

The patient is a 64-year-old man who had a previous elective open repair of a 5cm infra-renal AAA in February 1998. At that time he was noted to have an asymptomatic 4cm TAA. He was a smoker of 20 cigarettes/day with a history of mild chronic renal failure, hypertension, and hypercholesterolaemia.

Surveillance computerized tomography (CT) imaging demonstrated fairly slow increments in the size of the aneurysm which commenced in the descending thoracic aorta distal to the origin of the left subclavian artery and continued through the diaphragm to just above the coeliac axis in the abdominal aorta. The aneurysm had increased to 6cm in maximal diameter by June 2002. Open repair of the TAA was deemed inadvisable due to the high risk of mortality in the peri-operative period as well as the likelihood of paraplegia, especially in patients with a previous open AAA repair. By March 2003, the maximal diameter of the TAA had increased to 6.2cm with a top neck diameter of 3.1cm, neck length of 5.0cm, distal neck diameter of 3.0cm and distal aortic diameter of 2.8cm. Following review of his CT films, it was felt that an endovascular thoracic stent would be technically feasible but as the stent would occlude the coeliac axis and superior mesenteric arteries, open bypass would be required to these vessels to preserve the blood supply of the bowel.

A laparotomy and left groin incision were performed to allow access to the previous aortic repair and visceral vessels (Fig 1a) and also to facilitate deployment of the thoracic endograft through the common femoral artery. A 10x8mm Dacron bifurcated prosthesis (Gelsoft Plus®, Sulzer Vascutek Ltd, UK) was used to bypass from the anterior aspect of the

previous infrarenal aortic graft to the superior mesenteric artery and coeliac axis (Figs 1b, 2). Intra-operative doppler signals for all anastomoses were good. The limb to the coeliac axis was passed anterior to the pancreas and behind the stomach. The trunks of the coeliac axis and superior mesenteric arteries were then ligated using 2/0 prolene (Fig 1c). Omentum was placed over the aortic grafts and the mid-line wound was closed.

The thoracic stent (Talent®, Medtronic Ave, Watford, UK) was then deployed through the exposed left common femoral artery under careful radiological control (Fig 1c). Three separate endoprostheses were used in total to ensure complete exclusion of the aneurysm with a stent overlap of approximately 50% at each junction site. Proximally, a straight graft with a proximal and distal diameter of 36mm and length of 114mm was delivered followed by the deployment of two tapered distal extension stents with 38mm proximal and 34mm distal diameters and length of 112mm. An intra-operative check angiogram demonstrated satisfactory placement of the thoracic endograft with no evidence of endoleak (Figs 3a, 3b). The left groin wound was then closed. There were no major complications encountered throughout the procedure. He remained in the intensive care unit for 10-days and made slow but steady progress. He was discharged well on day 19.

Almost two-years later, he was admitted as an emergency with chest and abdominal pain. A CT scan confirmed a ruptured thoracic aneurysm arising from a slight dislocation between components of the previous thoracic stent (Fig 4). He underwent emergency endovascular repair where the dislocated grafts were bridged with two further thoracic endografts. Following initial slow progress in the high dependency unit due to a persisting left pleural effusion, he was discharged well on day-16. Since then, he has been well with no further stent-graft nor aneurysm related complications.

DISCUSSION

Endovascular repair of AAA is a widely documented and accepted technique.^{1,4} As with AAA stenting, endovascular

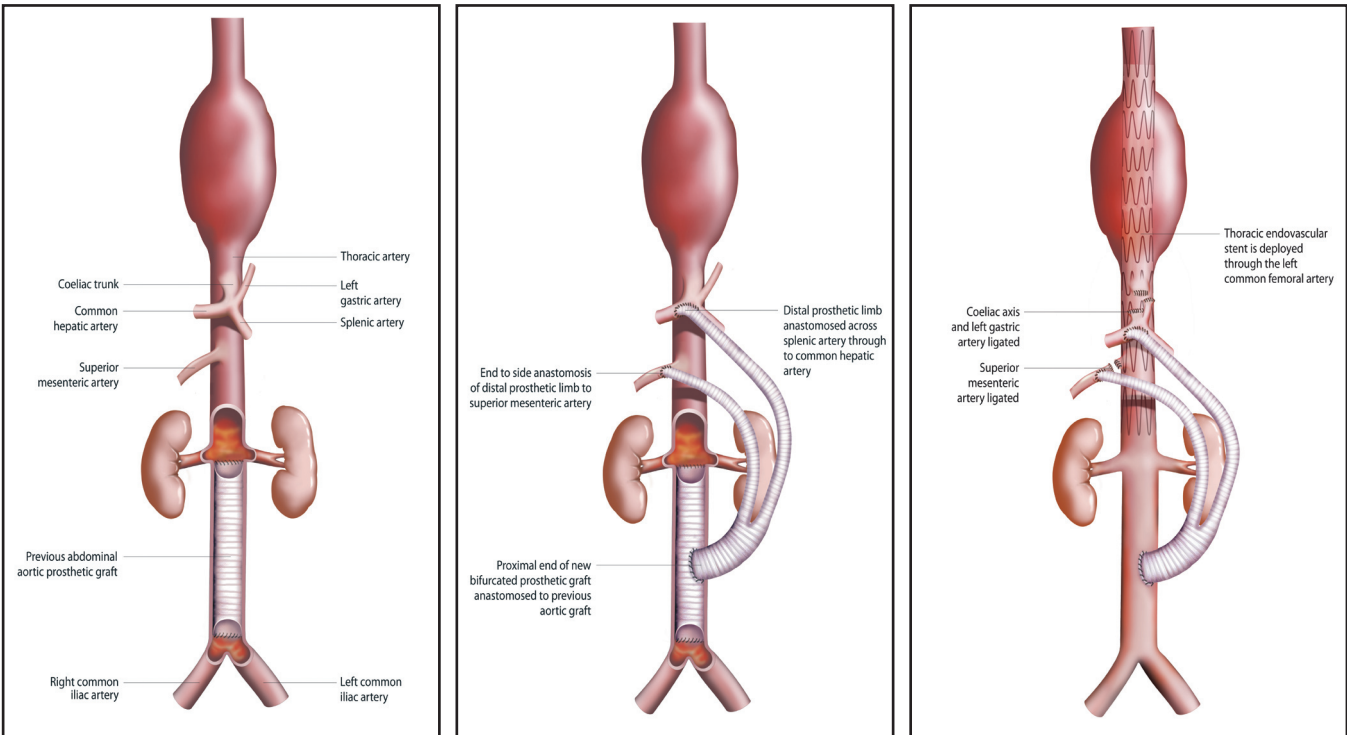
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Fig 1.



Stage a) Anatomical representation of the TAA and previous AAA repair.

Stage b) A bifurcated prosthesis is anastomosed to the previous AAA graft and then distally to the superior mesenteric arteries and coeliac trunk vessels.

Stage c) The native visceral vessels are clamped and ligated. The thoracic endograft is then deployed to the TAA.

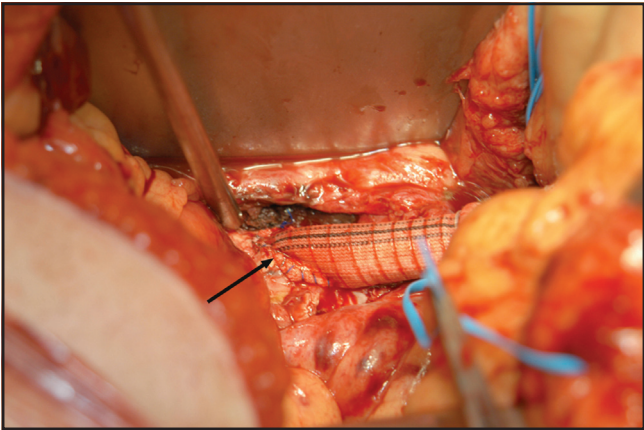
exclusion of TAA's requires relatively straight, normal segments of aorta both proximally and distally for device fixation. When the TAA involves the brachio-cephalic vessels proximally, or the visceral vessels distally, certain difficulties arise due to impingement or exclusion of the native vascular flow by the endograft itself. The native vessels often have to be re-implanted or bypassed elsewhere in the aortic tree. In this case, the TAA commenced below the left subclavian

artery and continued distally to just above the coeliac axis. In order to provide an adequate landing zone, both the coeliac axis and superior mesenteric artery had to be covered by the stent graft. This meant that both vessels had to be relocated.

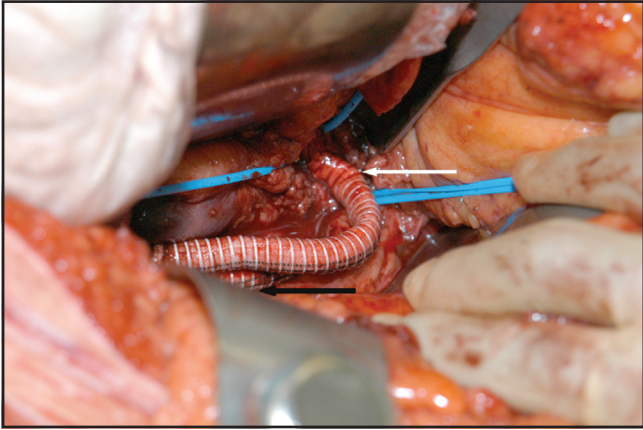
The transabdominal approach facilitated visceral arterial bypass prior to ligation of native vessels without the need for aortic cross-clamping. This resulted in a reduction in the duration of bowel ischaemia. Due to the anatomy of a thoraco-

Fig 2.

Intra-operative images.



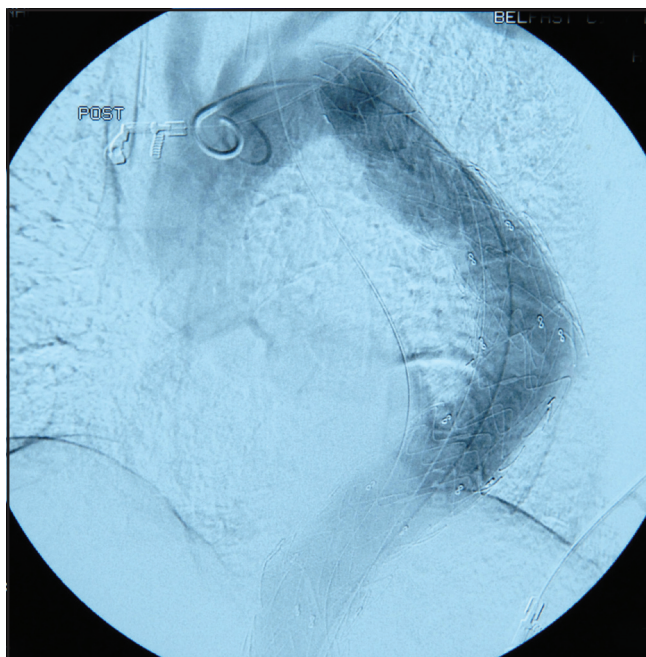
a) Proximal anastomosis to the previous aortic prosthesis (black arrow).



b) Distal anastomosis to the superior mesenteric artery (black arrow) and then to splenic artery across to the common hepatic artery (white arrow).

Fig 3.

An intra-operative check angiogram demonstrated satisfactory placement of the thoracic endograft with no evidence of endoleak.



a) Proximal portion of thoracic endograft deployed distal to the origin of the left subclavian artery.



b) Distal portion of the thoracic endograft extending down to just above the renal arteries. The visceral revascularization prosthetic grafts to the coeliac axis and superior mesenteric artery can also be identified.

abdominal aortic aneurysm, we were not able to perform antegrade bypass grafting to the visceral arteries from the proximal aorta which would have offered a shorter, more direct

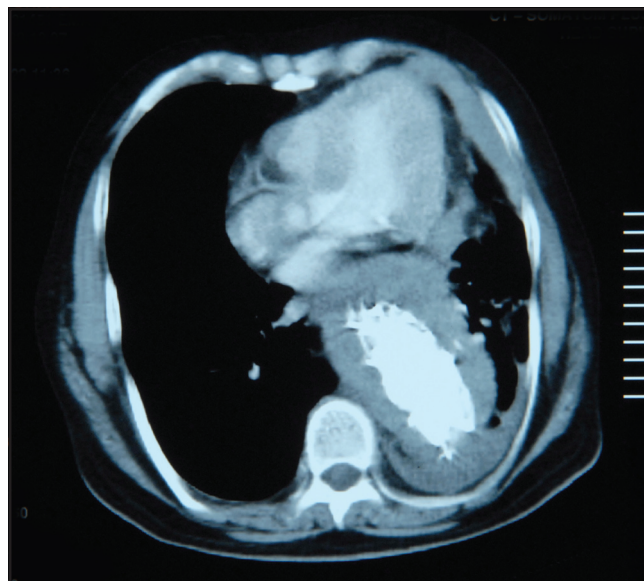


Fig 4.

Computerised tomography scan demonstrating the ruptured thoracic aortic aneurysm arising from a slight dislocation between components of the previous thoracic stent resulting in a left haemothorax.

bypass grafting route. The retrograde approach adopted here was a technically easier option and most importantly avoided the use of supraceliac aortic cross clamping. Although the long-term safety and durability of retrograde bypass grafting has yet to be proven, early reports are encouraging with retrograde graft patency rates of 98% at 8-months following CESA and 90-95% at 36-months following procedures for chronic mesenteric ischaemia and renal artery stenosis.⁵ We also tried to minimise intraperitoneal routing of the Dacron grafts by utilising the retroperitoneal route.

While peri-operative mortality is dramatically reduced by the use of a stent graft, the endovascular portion of the CESA is not without risk. Vascular injury, device malfunction, and atheroembolic events during device positioning and deployment have all been reported.⁶ Longer term studies have also raised concerns regarding the significance of endoleaks and endotension, and aspects of stent durability, including migration, kinking and material disintegration over time.⁷ Unfortunately, these complications are not always easily amenable to correction as shown in this case. CESA has also been utilized elsewhere in the aortic tree; aortic arch aneurysm endograft exclusion with bypass grafting of the ascending aorta to the brachio-cephalic trunk and left common carotid artery, and relocation of the iliac artery bifurcation to facilitate endovascular repair of AAA with extensive iliac artery involvement.⁸⁻⁹

We have reported a successful outcome for the management of complex aortic aneurysm pathology. With advances in endovascular devices using branched devices it is hoped that future complex TAA's may be treated with minimally invasive techniques alone which would incorporate side branch cannulation and branch graft deployment.¹⁰ However, for this technique to become a viable alternative in the management of TAA, the long-term durability of endovascular endografts has still to be proven.

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